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實したこと以外は実施例1と同様に行った。

【0044】比較例1

実施例1との比較のために、実施例1のEPDMとしてエスプレンE P 5 7 5 4の添加量を85重量部から100重量部に変更すると共に、SBR 1502を使用しなかつたこと以外は実施例1と同様に行った。

【0045】比較例2

実施例1との比較のために、実施例1のEPDMとしてエスプレン5 7 5 4の添加量を85重量部から80重量部に変更すると共に、SBR 1502の添加量を15重量部から20重量部に変更したこと以外は実施例1と同様に行った。

【0046】各実施例及び比較例の配合割合（組成物配合）と評価結果とを併せて以下の表1及び表2に示す。

【0047】表1に示す評価結果から、実施例1から実施例5のゴム組成物を用いたスponジローラは、低いス

ポンジ硬度を有しつつ、平均セル径が150μm以下の微細なセル径を有していることが判明した。このSBRを少量添加することによってによってセル径が改善される理由は定かではないが、ベースゴムであるEPDMとSBRの加硫速度が異なりSBRの加硫速度は早いために、かかる組成物を加熱・発泡する際にSBRが先に加硫し内部圧がかかるためではないかと推考する。更に、比較例1のゴム組成物を用いたスponジローラにおいては、セル径が粗いために転写ローラなどのスponジローラとしては不適切であることが判明した。また、比較例2のゴム組成物を用いたスponジローラにおいては、SBRの添加量が多くて加硫発泡しないために実用使用に供しないことが判った。

【0048】

Table 1

Examples

	実験結果				
	1	2	3	4	5
配合(重量部)					
EPDM	85	90	93	95	97
SBR	15	10	7	5	3
評価結果					
未加硫ゴムの特性					
A-E-粘度 (ML _{1,4} , 100°C)	29	28	28	27	27
スponジの物性					
スponジ硬度 (JIS-K-C)	40	37	36	35	33
平均セル径 (μm)	90	90	90	100	140

Properties of obtained sponges

【0049】

【表2】

Sponge hardness(ASKER C) いた

Average cell diameter (μm)

	比較例	
	1	2
配合(重量部)		
EPDM	100	80
SBR	0	20
評価結果		
未加硫ゴムの特性		
A-E-粘度 (ML _{1,4} , 100°C)	26	発泡
スponジの物性		
スponジ硬度 (JIS-K-C)	30	せず
平均セル径 (μm)	200	す

【0050】〇EPDM：エスプレンE 5 7 5 4 住友化学工業株式会社製 EPDM (ムーニー粘度30 (ML_{1,4}, 100°C)) の商品名

〇SBR : SBR 1502 (住友化学工業株式会社製商品名)

〇表記載の配合の他、共通配合として、下記のものを用

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[HOME](#) > [ゴム](#) > ゴムの硬さ(硬度)

ゴムの硬さ(硬度) Rubber Hardness

[ゴムの硬さ、柔らかさ](#)
[ゴムの硬さの規格\(表記方法\)](#)
[ゴムの硬さ比較表](#)

ゴムの硬さ、柔らかさ

ゴムの最大の特徴に、他の材料と比べて曲げたり、伸ばしたり、縮めたりと大きく変形させることができます。この変形にかかる力の強弱、つまり硬さとか柔らかさという感覚的な表現を何らかの物理的手段によって測定する計測器を硬度計といい、その測定値を硬度といいます。測定方法や、硬度の表記方法も色々と種類があり、ゴム材料に適当なものを選定する必要があります。硬質ゴムのように硬いゴム製品とゴムスponジのように柔らかい物を同じ測定方法で計測するのは、無理があります。

ゴムの硬度で從来から国内では、Ha(JISスプリング式 HeのHはHardness、eはspring)が多く使用され、「ゴムの硬度は?」との問い合わせに「He70」とか「He50」となどと表現していました。さらには、「70度」や、ただ「70」というだけでHeの単位であると理解されていました。しかしながら最近では、国際的な取引も多く、ISO(国際標準化機構)やデュロメータ(ショア)などに準拠したA型が使用されることが多くなりました。

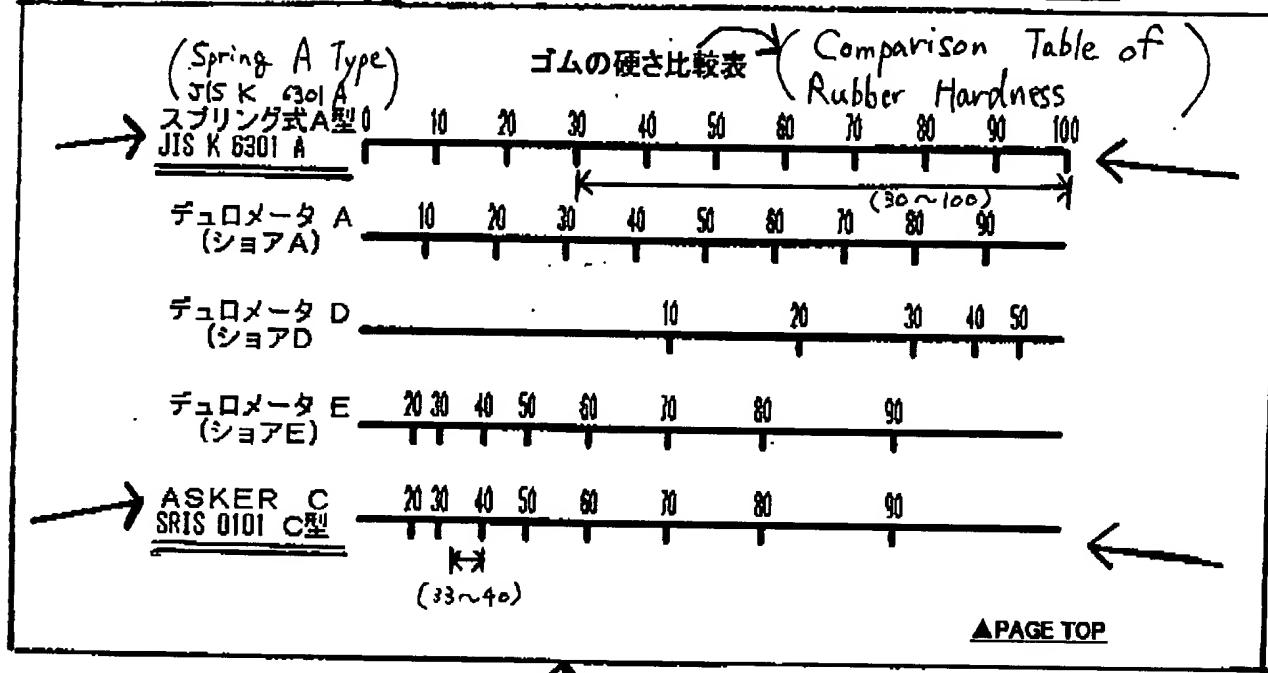
また、ゴムのスponジや軟質ゴムを測定する時によく使用されるものにアスカーカーC(ASKER C)があります。これは、日本ゴム協会標準規格(SRIS)に規定されています。

* This table relates to expression manners of ^{▲PAGE TOP} rubber hardness
as to various kinds of specification of rubber hardness.
ゴムの硬さの規格

規格	種類	硬度が50度の場合の表記方法	
		1秒以内(又は直ちに)の場合	15秒後の場合
JIS K 6301	スプリング式A型	50He JIS A	/
	スプリング式B型	50He JIS C	/
JIS K 6253	デュロメータタイプA (ショアA)	A 50	A 50/15
	デュロメータタイプD (ショアD)	D 50	D 50/15
	デュロメータタイプE (ショアE)	E 50	E 50/15
JIS K 7215	デュロメータタイプA (ショアA)	HDA 50	/
	デュロメータタイプD (ショアD)	HDD, 50	/
ASTM D 2240	デュロメータタイプA (ショアA)	A/50/1	A 50/15
	デュロメータタイプD (ショアD)	D/50/1	D 50/15
ISO 7619	デュロメータタイプA (ショアA)	A/50/1	A 50/15
	デュロメータタイプD (ショアD)	D/50/1	D 50/15
	デュロメータタイプA	A/50/1	A 50/15

ISO 868	(ショアA) デュロメータ タイプD (ショアD)	A 90/1 D/50/1	A 90/10 D 50/15
SRIS 0101	スプリング式 アスカ-C型	ASKER C 50 (印圧面を接触させたとき、及び30秒後)	

▲PAGE TOP



Please note the portions indicated by the arrows.

JIS

JAPANESE INDUSTRIAL STANDARD

Physical Testing Methods
for Vulcanized Rubber

JIS K 6301 -1975

Translated and Published

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Japanese Standards Association

4.5 Rearrangement of Test Results Test results shall, as a rule, be denoted as the average of permanent tension sets of two test pieces.

4.6 Record Following items should be recorded in the test results.

- (1) Permanent tension set (%)
- (2) Shape and pattern of the test piece
- (3) Temperature of test
- (4) Other necessary items

5. Hardness Test

5.1 Purpose This test shall be performed for the measurement of hardness of the vulcanized rubber. Hardness test shall, as a rule, be performed by one of the following method.

- (1) Spring type hardness test (Type A and Type C)
- (2) Constant load type (Olsen) hardness test
- (3) Constant load type (Pusey-Johnes) hardness test

5.2 Spring Type Hardness Test (Type A and Type C)

5.2.1 Test Piece A test piece shall not, as a rule, be less than 12 mm thick in type A. In case that the thickness is below 12 mm, put one on the top of another, if possible, to obtain the thickness of not less than 12 mm. In the case of type C, a test piece not less than 6 mm thick shall be used and in case that the thickness is below 6 mm, put one on top of another, if possible, to obtain the thickness of not less than 6 mm. When the surface of the test piece's ⁽²⁾ to be measured is not flat, grind so as to make it flat.

Note ⁽²⁾ Surface to be measured should be large enough to let the loading surface of the tester come within the boundary to its area.

5.2.2 Tester Type A or type C of the spring type hardness tester shown in Fig. 3 shall be used as the tester.

Fig. 3

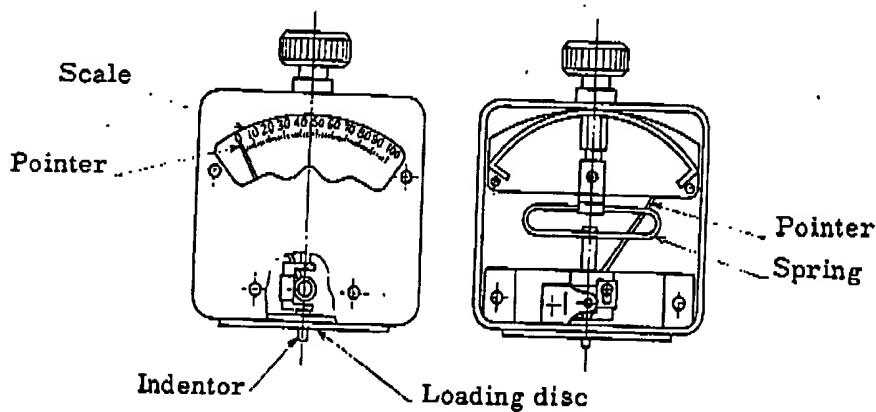
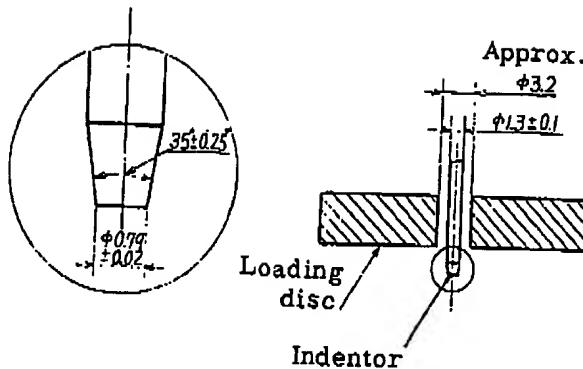


Fig. 4

Unit: mm



When the loading surface⁽³⁾ of this test comes into contact with the surface of the test piece indentor⁽⁵⁾ projecting from a hole in the center of the loading surface by means of a spring⁽⁴⁾ is pushed back by the surface of rubber and this distance is indicated by a pointer on the scale⁽⁶⁾ as the hardness.

The tester should be inspected at least every three months.

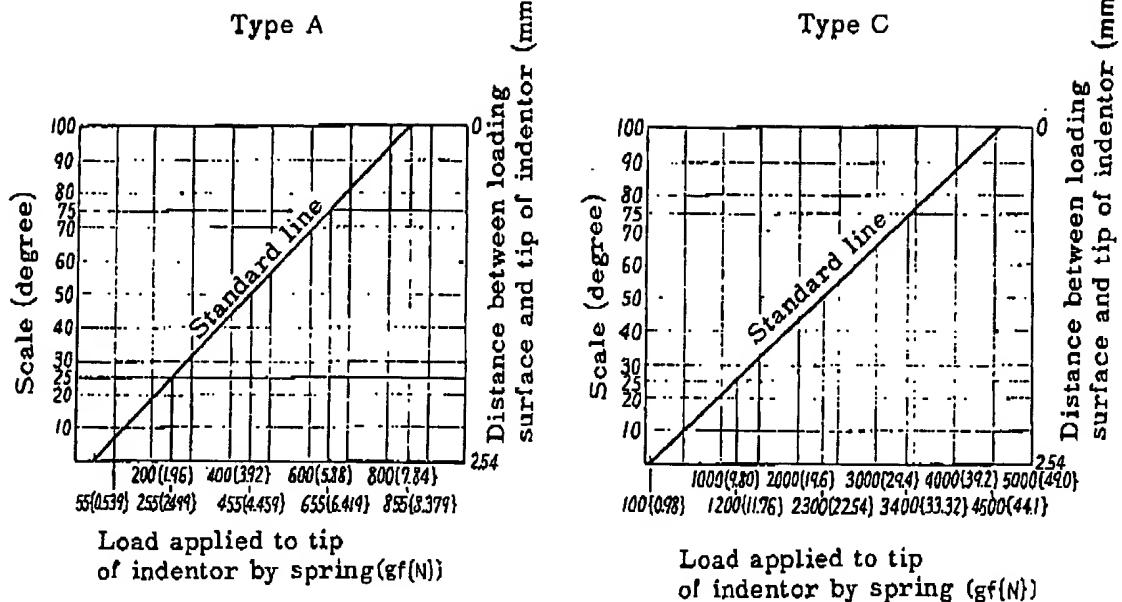
Notes⁽³⁾ The loading surface is a plane at right angles to the indentor and has a hole in its centre to pass through the indentor. Diameter of the hole should be not less than 10 mm.

⁽⁴⁾ Tolerance on the standard line (refer to Fig. 5) showing the relation among the scale, motion of the indentor and force of the spring shall be ± 8 g in case of type A and ± 20 g in case of type C. Further there should be no play between the motion of indentor and that of pointer.

⁽⁵⁾ Material of indentor shall be highly resistant to wear and also highly resistant to rust and shape and dimensions of indentor shall be as shown in Fig. 4. The indentor shall be fitted correctly at the center of the hole of the loading surface and when the pointer indicates zero on the scale the tip of the indentor shall be projected from the loading surface just be $2.54 - 0.05$ mm and when the pointer indicates 100 on the scale the tip of the indentor shall be on the same level with the loading surface.

⁽⁶⁾ The scale shall be divided evenly from 0 to 100.

Fig. 5



5.2.3 Testing Method Keep the tester vertically and let the loading surface contact with the test piece so as to make the indenter vertical to the surface of the test piece to be measured. Then immediately read the scale and obtain the hardness of the test piece. In case that the reading shall be taken after a certain hour elapsed from making contact with the loading surface, the tester shall be kept vertically and it is desirable to use a proper auxiliary apparatus which is constructed so as to make the indenter perpendicular to the surface to be measured before the test.

In this case vertically press type A tester with a load of 1000 gf {9.81 N} and type C tester with a load of 5000 gf {49.03 N} and read the scale.

Remark: Type C hardness tester is suitable for the sample which shows the hardness of about more than 70 by type A. Moreover, it is desirable to use type C tester for the sample, measured values of which is below 90 and above 30.

5.3 Constant Load Type (Olsen) Hardness Tester

5.3.1 Test Piece Shape and dimensions of the test piece should, as a rule, be not less than 12 mm in thickness and a disc shape 50 mm in diameter having flat surface and uniform thickness.

5.3.2 Testing Apparatus Olsen type hardness tester shown in Fig. 6 shall be used as the tester. This tester consists of a smooth and horizontal test piece holder, a loading surface⁽⁷⁾ to press the surface of the test piece, an indenter⁽⁸⁾ which gives a dent on the test piece, a loading apparatus⁽⁹⁾ capable of applying load completely without giving impact to the indenter and a dial gauge⁽¹⁰⁾ for the measurement of the depth of depression.

Notes (7) Loading surface shall be the load of 2268 ± 21 gf { 22.22 ± 0.21 N}

(8) Indenter shall be that having a tip of hemispherical form 2.38 ± 0.02 mm in diameter.

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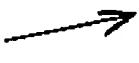
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CLAIMS

[Claim]

[Claim 1] The rubber constituent for sponge whose weight ratios of (A)/(B) following (A) component and (B) component are contained, and are 85 / 15 - 97/3.

(A): Rubber which has a double bond in an ethylene-propylene-nonconjugated diene copolymer rubber
(B): principal chain [a claim 2] (B) The rubber constituent of the claim 1 publication whose component is styrene-butadiene copolymer rubber.

[Claim 3] Sponge rubber which consists of a rubber constituent of claim 1 publication.

[Claim 4] The manufacture technique of a sponge roller of being the manufacture technique of a sponge roller of having a sponge layer on the periphery of a rodling, arranging the rubber constituent of claim 1 publication on the periphery of a rodling, and carrying out the curing foaming of this rubber constituent.

[Translation done.]

does not the hardness range set out in the claims
(Applicant provides evidence).

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DETAILED DESCRIPTION

[Detailed description]

[0001]

[The technical field to which invention belongs] this invention relates to the manufacture technique of the rubber constituent for sponge, sponge rubber, and a sponge roller. furthermore, in detail, this invention is alike and relates to the manufacture technique of the suitable rubber constituent for sponge for an imprint roller, an electrification roller, etc. which are installed around a photo conductor in image formation equipments, such as an electronic copying machine and a laser beam printer (it is hereafter described as LBP), sponge rubber, and a sponge roller

[0002]

[Prior art] In recent years, in an electronic copying machine, LBP, etc., the imprint roller which imprints the picture image on a photo conductor to the imprint material which electrification and the imprint in image formation equipment have changed to a mechanical control by roller from the charger formula by the conventional wire corotron, contacts a photo conductor, and passes the contact section with this photo conductor, and the electrification roller with which a photo conductor is contacted and this photo conductor is charged are being adopted with an eye on ozone loess. Such a roller needs to be a low degree of hardness, in order to acquire a high-definition picture image, and generally sponge rubber is applied.

[0003] It is divided roughly into two kinds, the foaming-in mold method, and the free foaming method, as the manufacture technique of a sponge type roller.

[0004] the rubber constituent with which the foaming-in mold method contained the foaming agent around the rodding -- forming -- after slack and metal mold -- the inside of a mold cavity -- installing -- metal mold -- it is the technique of making it heating and foaming inside and manufacturing a roller, and since the diameter detailed because of stabilization of electric resistance of a cell (foam) is demanded with an imprint roller or an electrification roller, the manufacture technique which forms sponge rubber by the foaming-in mold method which a detailed cell tends to acquire is in use however -- the foaming-in mold method -- usually -- metal mold -- although it divided and came out, there was a trouble where the sponge degree of hardness after foaming since it is difficult to adjust [which teaches rubber to about 70 - 90% of the capacity of a mold cavity] to the specified quantity varied

[0005] There is a method of heating, after extruding with an extruder the rubber constituent which contained the foaming agent beforehand with the technique of forming the rubber constituent which the free foaming method is divided roughly into two more kinds on the other hand, and contained the foaming agent around the rodding, heating after slack, making it foaming, and manufacturing a roller to the shape of a hose, making it foam, creating a sponge rubber hose, inserting after slack and a rodding, and manufacturing a roller. However, by the free foaming method, although it could foam, without being regulated by the capacity in a mold cavity, the diameter of a cell of sponge had greatly the fault that the variation in the diameter of a cell was large. Although it is mitigated when it extrudes and the extruder with a vent (vacuum length) is sometimes used, this diameter of a cell By the technique of extruding a rodding simultaneous, in case a crosshead is used at the time of a knockout among meances

to form the rubber layer of non-vulcanization especially in the periphery of a rodding and rubber is extruded, and forming the rubber layer of non-vulcanization in the periphery of a rodding Since the load at the time of a knockout is large, the Mooney viscosity of a rubber compound needs to use the constituent of the hypoviscosity below 25 (it is 100 degrees C at measurement condition:ML 1+4) grades. There was fault that the variation in the diameter of a cell was not improved even if it uses the extruder with a vent, when such a constituent is used.

[0006]

[Object of the Invention] this invention is made in view of these points, and consists in the point of offering the manufacture technique of the sponge rubber and the sponge roller using the rubber constituent and this rubber constituent with which the diameter of a mean cell can offer the sponge rubber of the detailed and uniform diameter 150 micrometers or less of a cell also in the free foaming method.

[0007]

[The means for solving a technical problem] That is, among this inventions, invention of one contains following (A) component and (B) component, and relates to the rubber constituent for sponge whose weight ratios of (A)/(B) are 85 / 15 - 97/3.

(A): Rubber which has a double bond in an ethylene-propylene-nonconjugated diene copolymer rubber (B):principal chain [0008] Moreover, the second invention relates to the sponge rubber which consists of the above-mentioned rubber constituent among this inventions.

[0009] Furthermore, among this inventions, the third invention is the manufacture technique of a sponge roller of having a sponge layer on the periphery of a rodding, arranges the rubber constituent of claim 1 publication on the periphery of a rodding, and relates to the manufacture technique of a sponge roller of carrying out the curing foaming of this rubber constituent.

[0010]

[Gestalt of implementation of invention] (A) component of this invention is ethylene-propylene-nonconjugated diene copolymer rubber (EPDM). As nonconjugated diene, dicyclopentadiene, ***** diene, 5-methylene-2-norbornene, 5-ethylidene-2-norbornene, 1, and 4-hexadiene etc. is illustrated.

[0011] As concrete grade of ethylene-propylene-nonconjugated diene copolymer rubber Mitsui EPT 0045, 1035, 1045, 1060, 1070, 1071, 3012P, 3045, 3042E, 3062E, 3070, 3072E, 3090E, 8075E, 3091, 3095, 4010, 4021, 4045, 4070, 4095 (above) Mitsui Petrochemical Industries, Ltd. make A tradename, id ***** 201, 301, 305, 400, 501A, 502, 505, 505A, 512F, 514F, 522, 524, 532, 552, 553, 567, 582F, 586,600F, 601F, 606, 670F, 671F, 673, 5214, 5754, 6506S, 6182F (above, tradename by Sumitomo Chemical Co., Ltd.), JSR EP912P, EP01P, EP02P, EP941P, EP961SP, EP07P, EP57P, EP181SP, EP11, EP43, EP93, EP24, EP27, EP21, EP132, EP22, EP25, EP33 and EP35, EP37C/F, EP65, EP51, EP57C/F, EP75F, EP86, EP96 and EP98, EP103AF, EP106EF, EP107F, EP801E, EP001DE (above) Japan Synthetic Rubber Co., Ltd. make A tradename, ***** 520, 720, 820, 312, 512, 712, 812, 314, 514, 714, 378, 578, 778, 4502, 4802, 4778, 4703, 4903, 5631A, 512x50,708x15,509x100 (above, tradename made from the Idemitsu dee ***** Inc.), NORDEL 1040, 1070, 1145, 1320, 1440, 1470, 1660, 2522 or 2722/P, 2744/P2760/P (above, tradename by E. I. du Pont de Nemours& Co. (DuPont) (United States)), Epsyn 40-A, 70-A, 55, 2308, 2506, 4506, 4906, 5206, 5508, 5805 and 7506, E801, N557, N597, N997, P557, P558, P597, MDE239, MDE248 (above) Copolymer rubber - and made in - chemical corporation (Copolymer Rubber &Chemical Corporation) (United States) Tradename, POLYSAR 227, 306, 345, 585, 487XP, 865, 965, 5465, 5672X, 5875, 6463 (above, poly-sir rubber corporation (Polysar Rubber Corporation) (United States) tradename), etc. are illustrated.

[0012] In this invention, a kind of ethylene-propylene-nonconjugated diene copolymer rubber may be used independently, and for the purpose of [, such as a Mooney viscosity a propylene content, the amount of oil exhibition oil, and a curing speed] adjustment, two or more kinds of things may be blended suitably, and may be used.

[0013] (B) component of this invention has the viewpoint of a mulling manipulation stability to desirable styrene-butadiene copolymer rubber, although it is rubber which has a double bond and NR

(natural rubber), SBR (styrene-butadiene copolymer rubber), NBR (nitrile rubber), IR (polyisoprene rubber), CR (chloroprene rubber), BR (polybutadiene rubber), IIR (isobutylene isoprene rubber), etc. are raised as an example into a principal chain.

[0014] Styrene-butadiene copolymer rubber is random copolymerization rubber of styrene and a butadiene, and although mainly made by the emulsion-polymerization method, it also has rubber by the solution polymerization method.

[0015] Since styrene-butadiene copolymer rubber has many modalities, it defines a code number, the modality is unified, and 1500, 1502, 1507, 1707, 1708, 1712, 1778, 1778N, 1778J, 1778S, etc. are illustrated. As a manufacturing company, Sumitomo Chemical Co., Ltd., Japan Synthetic Rubber Co., Ltd., Asahi Chemical Industry Co., Ltd., and Nippon Zeon Co., Ltd. are illustrated.

[0016] In the weight ratio of (A)/(B), (A) in the rubber constituent of this invention and the rate of (B) are 85 / 15 - 97/3, and are 90 / 10 - 95/5 preferably. If (A) is [too little / ((B) is excessive)], a foaming will become difficult, and if (A) is excess (too little / (B) /) on the other hand, the diameter of a foaming cell will become excessive.

[0017] A usual sulfur curing system is applicable to curing (bridge formation) of the rubber constituent of this invention. The sulfur used for sulfur vulcanization is added by the amount of below [used] 5 weight section grade to the total quantity 100 weight section of (A) and (B). As this sulfur, recovery sulfur is ground, what was made into the flour is used, and **** mark flour sulfur 150mesh, 200mesh, 300mesh, and 325mesh (above, tradename by Tsurumi chemical-industry incorporated company) are illustrated by this. Moreover, the surface treatment sulfur which improved dispersibility etc. is also used suitably, and ape facsimile A, 200S, managing contractor, PS, PMC (above, tradename by Tsurumi chemical-industry incorporated company), etc. are illustrated by this. Moreover, in order to avoid the bloom from an unvulcanized rubber, insoluble sulfur is used, and ***** sulfur (tradename by Japanese dry distillation industrial incorporated company), Sun Fell, and Sun Fell 90 (above, tradename by 3 Japanese Federation of Chemical Industry Workers' Unions Industries) are illustrated by this.

[0018] moreover, when especially a low compression set is demanded A sulfur-containing organic compound is used for instead of [which does not use sulfur at all] as a curing agent (cross linking agent). to this The morpholine disulfide like ***** R (tradename by Kawaguchi Chemical Industry Co., Ltd.), The tetramethyl thiuram disulfide like an accelerator TMT (tradename by Kawaguchi Chemical Industry Co., Ltd.), The tetraethyl ***** disulfide like an accelerator TET (tradename by Kawaguchi Chemical Industry Co., Ltd.), The ***** thiuram tetrapod sulfide like an accelerator TRA (tradename by Kawaguchi Chemical Industry Co., Ltd.) etc. is illustrated, and 0.5-5 weight section grade addition is carried out to the total quantity 100 weight section of (A) and (B).

[0019] Moreover, usually, by sulfur vulcanization, a vulcanizate property and in order to improve a compression set and a manipulation stability especially, to the total quantity 100 weight section of (A) and (B), about 3-8 kinds of vulcanization accelerators carry out 0.5-3 weight section grade combined use, and are added, respectively. Thiazoles, thiourea, *****s, dithiocarbamic-acid salts, and guanidine are illustrated by this. As thiazoles, 2-mercaptobenzothiazole like accelerator M (tradename by Kawaguchi Chemical Industry Co., Ltd.), The dibenzo thiazole disulfide like accelerator DM (tradename by Kawaguchi Chemical Industry Co., Ltd.), N-cyclohexyl benzothiazole like accelerator CZ (tradename by Kawaguchi Chemical Industry Co., Ltd.), The N-oxy-diethylene-2-benzothiazole sulfenamide like an accelerator NS (tradename by Kawaguchi Chemical Industry Co., Ltd.), The N-t-butyl-2-benzothiazole sulfenamide like accelerator BNS-R (tradename by Kawaguchi Chemical Industry Co., Ltd.), N [like accelerator DZ-G (tradename by Kawaguchi Chemical Industry Co., Ltd.)] and N-dicyclohexyl-2-benzothiazole sulfenamide etc. is illustrated. As thiourea, the diethyl thiourea like an accelerator EUR (tradename by Kawaguchi Chemical Industry Co., Ltd.), the ethylene thiourea like accelerator 22-S (tradename by Kawaguchi Chemical Industry Co., Ltd.), etc. are illustrated. As *****s, the tetramethyl thiuram disulfide like an accelerator TMT (tradename by Kawaguchi Chemical Industry Co., Ltd.), The tetraethylthiuram disulfide like an accelerator TET (tradename by Kawaguchi Chemical Industry Co., Ltd.), The tetrabutylthiuram disulfide like an accelerator TBT (tradename by Kawaguchi Chemical Industry Co., Ltd.), The ***** thiuram tetrapod

sulfide like an accelerator TRA (tradename by Kawaguchi Chemical Industry Co., Ltd.), the tetramethylthiuram monosulfide like an accelerator TS (tradename by Kawaguchi Chemical Industry Co., Ltd.), etc. are illustrated. As dithiocarbamic-acid salts, the zinc dimethyldithiocarbamate like an accelerator PZ (tradename by Kawaguchi Chemical Industry Co., Ltd.), the diethyl dithiocarbamic-acid zinc like an accelerator EZ (tradename by Kawaguchi Chemical Industry Co., Ltd.), the zinc dibutylidithiocarbamate like an accelerator BZ (tradename by Kawaguchi Chemical Industry Co., Ltd.), the dithiocarbamic-acid tellurium like accelerator tangent line-PT (tradename by Kawaguchi Chemical Industry Co., Ltd.), etc. are illustrated. As guanidine, the diphenylguanidine like accelerator D (tradename by Kawaguchi Chemical Industry Co., Ltd.) etc. is illustrated.

[0020] The foaming agent used for usual ethylene-propylene-nonconjugated diene copolymer rubber as a foaming agent is applicable to the rubber constituent of this invention, a ***** carvone amide, azobisisobutyronitril, dinitrosopentamethylenetetramine, 4, and 4'-oxy-screw (benzene sulfonylhydrazide) etc. is illustrated by this, and 1-10 weight section grade addition is carried out at it to the total quantity 100 weight section of (A) and (B). Moreover, 1-10 weight section grade combined use use of metallic soaps, such as mineral salt, such as a decomposition assistant, for example, a zinc oxide, a 3 basic lead sulfate, etc., a zinc stearate, and a lead stearate, the urea compound, etc. is carried out to the total quantity 100 weight section of (A) and (B) if needed.

[0021] In order to obtain the constituent of a low degree of hardness, mixture and variance of a compounding agent are helped, fabrication operations, such as rolling and a knockout, are made easy, and in the tackiness of an unvulcanized rubber, increase and in order to make to fabricate, the softener about 10 - 60 weight section is preferably filled up with the rubber constituent of this invention below 180 weight section to (A) 100 weight section.

[0022] This softener needs to consider the compatibility with ethylene-propylene-nonconjugated diene copolymer rubber, and, for that, its use of paraffin-series oil, naphthene oil, aromatic system oil, etc. is good.

[0023] As a softener of paraffin-series oil, it is Diana process-oil PW-32, PW-90, PW-150, PW-380, PS-32, PS-90, PS-430, PX-32, and PX-90 (above). Idemitsu Kosan, Inc. make A tradename, ***** 845 (above, tradename by Esso Sekiyu, Inc.), ***** PA-95, PA-100, PA-140 (above, tradename by Kobe oil chemical-industry incorporated company), The ***** processes 10, 40, and 40C (above, tradename by COSMO OIL CO., LTD.), ***** 110, 115, 120, 130, 150, 180, 2100, 2210, and 2280 (above) (Sunper) Nihon Sun Microsystems petroleum incorporated company make A tradename, ***** P-200, P-400, P-500 (above, tradename by FUJI KOSAN, LTD.), Mitsubishi 10, Mitsubishi 12 (above, tradename by Mitsubishi Oil Co., Ltd.), etc. are illustrated.

[0024] As a softener of the aforementioned naphthene oil, it is Diana process-oil NS-24, NS-100, NM-26, NM-68, NM-150, NM-280, NP-24, NU-80, and NF-90 (above). tradename by Idemitsu Kosan, Inc., the ***** process oils 725 and 765 (above) tradename by Esso Sekiyu, Inc., ***** N-40, N-60, N-70, N-75, N-85 (above) The Kobe oil chemical-industry incorporated company make A tradename, shelf Rex 371JY, 371N, 451, N-40, 22, 22R, 32R, 100R, 100S, 100SAs, 220RS, 220S, 260, 320R, 680 (above) The tradename made from shell ***** Inc., ***** (Sunthene) 310, 380, 410, 415, 420, 430, 450, 480, 3215, 4130, and 4240, CiroLight R.P.O. (above) Nihon Sun Microsystems petroleum incorporated company make A tradename, ***** of No. 2 (tradename by Nippon Oil Co., Ltd.), ***** 1150N and 1400N (above, tradename by FUJI KOSAN, LTD.), Mitsubishi 20 (tradename by Mitsubishi Oil Co., Ltd.), ***** 32 and 38 (above, tradename by Mobil Sekiyu, Inc.), ***** PN-3 (tradename by *****-ized incorporated company), etc. are illustrated.

[0025] As a softener of the aforementioned aromatic oil, it is Diana process-oil AC-12, AC-460, AE-24, AE-50, AE-200, AH-16, and AH-58 (above). tradename by Idemitsu Kosan, Inc., the ***** process oils 110 and 120 (above) tradename by Esso Sekiyu, Inc., ***** HA-10, HA-15, HA-30, HA-35 (above) The Kobe oil chemical-industry incorporated company make A tradename, ***** process 40A (tradename by COSMO OIL CO., LTD.) JSO Aroma790 (tradename by Nihon Sun Microsystems petroleum incorporated company), ***** 300,700 (above, tradename by Nippon Oil Co., Ltd.), ***** #1, #3, #5 (above, tradename by FUJI KOSAN, LTD.), Heavy process oil

Mitsubishi 34, Mitsubishi 38, Mitsubishi 44 (above, tradename by Mitsubishi Oil Co., Ltd.), Mobile ***** K, 22 and 30,130 (above, tradename by Mobil Sekiyu, Inc.), ***** LPO-R, LPO-V, PF-1, PF-2 (above, tradename by *****-ized incorporated company), etc. are illustrated.

[0026] Moreover, the G (2-ethylhexyl) free-wheel-plate rate like DOP (tradename by large 8 chemical-industry incorporated company), or ***** 80 (tradename by Kao Corp.) (DOP), Leo FREX 9P (tradename made from shell ***** , Inc.), and the diamond sizers 11 and 99 (above) Mitsubishi Chemical, Inc. make The higher alcohol and the free-wheel-plate rate like a tradename, The G soak chill free-wheel-plate rate like DIOP (tradename made from *****-***** (Wacker-Chemie) (Germany)) (DIOP), The G (2-ethylhexyl) sebacate like ***** sizer DOS (tradename by New Japan Chemical Co., Ltd.), The iso octyl and talloil-fatty-acid ester like Alizona208 (tradename made from the Arizona **** (Arizona Chem) (United States)), The tributyl phosphate like TBP (tradename by large 8 chemical-industry incorporated company) (TBP), The ***** ethyl phosphate like TBEP (tradename by large 8 chemical-industry incorporated company) (TBEP), The tricresyl phosphate like ***** sizer TCP (tradename by New Japan Chemical Co., Ltd.) (TCP), The cresyl ***** phosphate like CDP (tradename by large 8 chemical-industry incorporated company) (CDP), Koremoll CE The diphenyl alkane like 5422 (tradename made from BASF (Germany)), Thiokol The ** (butoxyethoxy ethyl) horse mackerel peat like TP-95 (tradename by the Morton International (Morton International) (United States) company) etc. can be used.

[0027] The aforementioned softener may carry out combined use addition of the oil of **** different species, although 1-2 kinds are used suitably and usually blend naphthene oil and paraffin-series oil if needed. Moreover, in consideration of the surface-lapping nature of the sponge rubber layer at the time of considering as a roller etc., the 5-50 weight section grade combined use use also of the factice (factice) like a brown factice, a white factice, a candy factice, a golden factice, a neo factice, and a non-sulfur factice (above, tradename made from the Tenma factice-ized *****) can be carried out to the total quantity 100 weight section of (A) and (B).

[0028] this invention -- the total quantity 100 weight section of (A) and (B) -- receiving -- usually -- 10 - 150 weight section -- the bulking agent of 20 - 100 weight section is added preferably

[0029] As the aforementioned silica system bulking agent, it is Aerosil 130, 200, 300, and 380, and R972 and R974 (above). tradename made from Japanese Aerosil, Inc., and the ***** seals QS13, QS30, QS38, and QS102 (above) Tokuyama Make The dry-type silica like a tradename, Carplex #67, #80, #100, #1120, XR, 22S, CS-5, CS-7 (above, tradename by Shionogi medicine manufacture incorporated company) and sill ton A, R-2 (above, tradename by Mizusawa chemical-industry incorporated company), ***** AL-1, Gu, U, UR, US (above, tradename by Tokuyama, Inc.), and the nip seal AQ, ER, LP, NA, NP, NS-K, VN3 (above) The tradename by Japanese silica incorporated company, and Ultrasil VN3 (Degussa AG (Degussa) (Germany) tradename), the wet silica like Hi-Sil233 (**** * G Industries (PPG Industries) (United States) tradename), etc. are illustrated.

[0030] Moreover, carbon black and the activation calcium carbonate like white **** CC, DD, O, and U (above, tradename by Shiroishi Industries), The special calcium carbonate like white **** A and AA (above, tradename by Shiroishi Industries), The magnesium silicate like a mistake TRON paper (tradename by Japanese mistake TRON incorporated company), High TRON, high TRON A, a micro light, US-100, US-150S, US-150SS, a high rack, the silicic-acid magnesium like high rack SS (above, tradename by Takehara chemical-industry incorporated company), ***** clay A (tradename made from hard clay:****, Inc.), and hardtop clay, Soft clay and crown clay (above, tradename by Shiroishi calcium incorporated company), and a ***** night, NN clay, special kaolin clay, ***** No. 5 clay, SPMA clay, union clay RC-1, ***** LL, hide light PX (above) The Takehara chemical-industry incorporated company make A tradename, JP-100 kaolin, 5M kaolin, NN kaolin, hard sill, and ST kaolin, the clay like ***** (above, tradename by Tsuchiya kaolin industrial incorporated company) (silicic-acid aluminum), ST-100, ST-200, Nulok321, Nucap100, Nucap190, Nucap200, Nucap390 (above) [ST-301 (above, tradename by Shiroishi calcium incorporated company), or] Product made from the Jay **** ***** (J. M.Huber) (United States) A tradename and Burgess KE, You may carry out combined use use of CB, the silane reforming clay like 5178 and 2211 (above,

tradename by the ***** pigment (Burgess Pigment) (United States) company), etc. timely.

[0031] In the rubber constituent of this invention, you may add the increase-in-quantity bulking agent about 10 - 100 weight section for the purpose of dimensional stability, a low cost, etc. to the total quantity 100 weight section of (A) and (B) if needed.

[0032] As the aforementioned increase-in-quantity bulking agent, it is Green. Ball (tradename by Inoue lime industrial incorporated company), and ***** TP-121, TP-121R, TP222H, TP-222HS, TP-123, TP-123CS (above) The Okutama Industries make The precipitated calcium carbonate like a tradename or silver W (white a masonry tradename by work incorporated company), ***** TRON SSB, SB, and S (above, tradename by Shiroishi calcium incorporated company), sunlight #100, #300, #700, #800, #1000, #1500, #2000, #2200, #2500 (above) tradename by Takehara chemical-industry incorporated company, NS#100, NS#200, NS#400, NS#600, NS#1000, NS#2300, NS#2500, NS#2700, NS#3000, SS#30, SS#80, NN#200, NN#500 (above) Japanese east powdering industrial incorporated company make A tradename, super S, SS, SSS, 4S, #1500, #1700, the whiting like #2000 (above, tradename by Maruo Calcium Co., Ltd.), JET-S (tradename by Asada milling incorporated company), talc GTA, CTA1, and CTA2, flour talc (above) Kunimine Industries, Inc. make A tradename, MS and MS-P, MS-A, ND, SW, and SW-E, SWA, SWB, SSS, SS, S (above) Japanese talc incorporated company make Talc (talc), such as a tradename, crystallite AA, VX-S, VX-S-2, VX-SR (above, tradename made from *****, Inc.) and Min-U-Sil 5, 10, 15, 30 (above) tradename by the you id silica (U. S.Silica) (United States) company, Imsil A-10, A-15, A-25, A-108 (above) The Illinois minerals (Illinois Minerals) (United States) company make Quartz powder like a tradename, JA-30W, 325M (above, tradename by Asada milling incorporated company), and NYAD 325, 400, and 1250G (above) Product made from ***** (NYCO) (United States) The wollastonite like a tradename (meta-silicic-acid calcium), Celite 270, 281, 501, 503, 505, 535, 545, 560, 577, FC, SSC, Super Floss Floss, Snow (above) The Jones-man building (Johns-Manville) (United States) company make A tradename, radio light #100, #200, #300, #500, #500S, # 600, #700, #800, and #800-S, #900, F, SPF, ***** like fine flow A and fine flow B (above, tradename by Showa Chemical Industry Co., Ltd.), The zinc oxide like two sorts (tradename by Sakai Chemical Industry Co., Ltd.) of zinc whites, an aluminum sulfate, a barium sulfate, a calcium sulfate, titanium oxide, second-class-sized molybdenum, etc. are illustrated, and 1 - some kinds are usually used together with a reinforcement nature bulking agent.

[0033] Since half-conductivity is required of the rubber constituent of this invention when applied to an imprint roller etc. The need is embraced. A conductive grant agent (tradename by DENKI KAGAKU KOGYO K.K.), for example, acetylene black, Conch ***** CF and SCF (above, tradename made from continental carbon (U.S.)), The Balkan Peninsula C and SC (above, tradename by Cabot Corp. (U.S.)), ***** black EC-600JD (tradename made from ***** black International (Netherlands)), Asahi HS-500 (tradename by Asahi carbon incorporated company), talker black #4500, #5500 (above) Tokai Carbon Co., Ltd. make Conductive carbon black, such as a tradename, Conductive zinc oxides, such as conductive zinc-oxide 23-K (tradename by Hakusui Chemical Industries, Inc.), and the conductive zinc oxide 1 (the Honjo Chemical, Inc. tradename), Antistatic calcium carbonates, such as EC-1 and EC-5 (above, Maruo Calcium tradename), The conductive tin oxide which doped antimony oxides, such as T-1 (tradename by MITSUBISHI MATERIALS CORP.) Although the conductive titanium oxide which doped antimony oxides, such as W-P (tradename by MITSUBISHI MATERIALS CORP.), is based also on a modality to the total quantity 100 weight section of (A) and (B), it is added 3 - 150 weight section grade timely.

[0034] Although the lubricant and internal mold releasing agent about 0.3 - 5 weight section can be added in the rubber constituent of this invention to the total quantity 100 weight section of (A) and (B) if needed because of an improvement of rubber kneading nature or knockout nature, since not much a lot of addition causes the bloom, bleeding, a lack of fusion, etc. to it, although it is based also on a modality, 0.5-1 weight section grade addition is usually carried out.

[0035] As the aforementioned lubricant or an internal mold releasing agent, the Mitsui highness waxes 100P and 110P, The low-molecular polyethylene like 200P, 210P, 220P, 320P, and 420P (above, tradename by Mitsui Petrochemical Industries, Ltd.), ***** S-20, S-30, S-40 (above, tradename by

Kao Corp.), FA-KR (tradename by Nippon Oil & Fats Co., Ltd.) and ***** fatty-acid SA-20, SA-300, SA-400 (above) the Asahi electrification incorporated company make the stearin acid like a tradename, and a plus -- fatty tuna -- gin -- The fatty-acid amide like plastic strike rosin S (above, tradename by Fujisawa Pharmaceutical Co., Ltd.), The fatty-acid nitrogen derivative like the ***** wax EBS (tradename made from lion ***** Inc.), The polar compound like Aflex42 (tradename made from lane ***** (Rein Chemi) (Germany)), and the mixture of a surfactant, Struktol High-class unsaturated-fatty-acid zinc like A60 (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)), Struktol Special fatty-acid zinc like EF44 (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)), Struktol Mixture of the fatty-acid calcium like WB16 (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)), and a fatty-acid amide, Struktol Fatty acid ester like WB42 (seal - and tradename made from - ***** (Schill& Seillacher) (Germany)), and mixture of a fatty-acid metal salt, Struktol The higher-fatty-acid ester hydrate like WB212 (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)), and mixture of an inorganic carrier, The polyhydric-alcohol fatty acid ester like StruktolWB222 (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)), Struktol The organic silicone condensate like WS180 (seal - and tradename made from - ***** (Schill& Seillacher) (Germany)), Struktol The mixture, the paraffine wax which processed the amount natural-fat group alcohol of macromolecules and aliphatic soap like W33floor line (seal - and tradename made from - ***** (Schill & Seillacher) (Germany)) to the inactive filler, A montan wax etc. is illustrated.

[0036]

[Example]

Although the example 1, next the more concrete example of the roller concerning this invention are shown below, this invention is not limited to these.

[0037] first, as ethylene-propylene-nonconjugated diene copolymer rubber (EPDM) which is (A) component Sumitomo E5754 (tradename by Sumitomo Chemical Co., Ltd.) 85 weight section, (B) SBR1502 (tradename by Sumitomo Chemical Co., Ltd.) as styrene-butadiene copolymer rubber (SBR) which is a component 15 weight section, NS#100 (tradename by Japanese east powdering industrial incorporated company) which is 70 weight section and a calcium carbonate as a bulking agent about ***** SO (tradename by Tokai Carbon Co., Ltd.) of carbon black 40 weight section, The Diana process oil PW380 (tradename by Idemitsu Kosan, Inc.) as a softener 50 weight section, Vesta 18 (tradename by Inoue lime industrial incorporated company) which is a calcium oxide as a dehydrating agent 5 weight section, Two sorts (tradename by Sakai Chemical Industry Co., Ltd.) of zinc whites as a zinc oxide 5 weight section, ***** S-20 (tradename by Kao Corp.) as stearin acid 1 weight section, A ***** carvone amide (cell microphone C- one: tradename by 3 ***** industrial incorporated company) as a foaming agent 7 weight section, *** mark flour sulfur 325mesh as a curing agent 1.0 weight section, As a vulcanization accelerator Accelerator CZ (tradename by Kawaguchi Chemical Industry Co., Ltd.) 1.0 weight section and accelerator DM ([by Kawaguchi Chemical Industry Co., Ltd.]) Are ****ed 0.5 weight section and accelerator M (tradename by Kawaguchi Chemical Industry Co., Ltd.) for tradename, and 0.6 weight section and the accelerator TMT(tradename by Kawaguchi Chemical Industry Co., Ltd.) 0.5 weight section are ****ed for 0.5 weight section and the accelerator TRA (tradename by Kawaguchi Chemical Industry Co., Ltd.). It *****ed with the rubber kneading roll of common knowledge of each, and the rubber constituent for rollers of non-vulcanization was obtained. That is, while a grand total of EPDM and SBR serves as 100 weight section, it becomes the constituent combination which carries out foaming agent 7 weight section inclusion.

[0038] And it is JIS because of a performance evaluation. K Based on 6300, the Mooney viscosity was measured at 100 degrees C. Next, the overall length of 8mmphi and the rubber section extruded the sponge rubber constituent for rollers of this example with the extruder with a vent, carrying out vacuum length with the rodding whose outer diameter is 320mm using a crosshead, and formed the rubber layer of non-vulcanization in the periphery of a rodding. Next, it foamed, while the 180-degree C continuous furnace was made to invest, heat and cure this rodding, and the sponge rubber roller was manufactured.

[0039] Next, after grinding the outer diameter of a sponge roller so that it may be set to 24mm, the sponge degree of hardness was measured with the ***** C hardness meter (tradename by macromolecule measuring instrument incorporated company) which is a hardness meter for sponge rubber specified by the SRIS(Society of Rubber Industry, Japan standard) 0101 expanded-rubber examining method. Next, after slicing the sponge layer of this sponge roller so that it may become a hoop direction in width of face of 2mm, a photograph of near the center of a sponge layer with a wall thickness of 8mm was taken by one 40 times the scale factor of this with the scanning transmission electron microscope, and it asked for the diameter of a mean cell of each sample from the size of the cell on a photograph.

[0040] While EPDM of example 2 example 1 was changed into the id ***** E5754 (tradename by Sumitomo Chemical Co., Ltd.) 90 weight section, it carried out like the example 1 except having changed the addition of SBR1502 into 10 weight section from 15 weight section.

[0041] While EPDM of example 3 example 1 was changed into the id ***** E5754 (tradename by Sumitomo Chemical Co., Ltd.) 93 weight section, it carried out like the example 1 except having changed the addition of SBR1502 into 7 weight section from 15 weight section.

[0042] While EPDM of example 4 example 1 was changed into the id ***** E5754 (tradename by Sumitomo Chemical Co., Ltd.) 95 weight section, it carried out like the example 1 except having changed the addition of SBR1502 into 5 weight section from 15 weight section.

[0043] While EPDM of example 5 example was changed into the id ***** E5754 (tradename by Sumitomo Chemical Co., Ltd.) 93 weight section, it carried out like the example 1 except having changed the addition of SBR1502 into 3 weight section from 15 weight section.

[0044] While the addition of id ***** EP5754 was changed into 100 weight section from 85 weight section as EPDM of an example 1 for the comparison, it carried out like the example 1 except the thing with example of comparison 1 example 1 for which SBR1502 was not used.

[0045] While the addition of id ***** 5754 was changed into 80 weight section from 85 weight section as EPDM of an example 1 for the comparison, it carried out like the example 1 except the thing with example of comparison 2 example 1 for which the addition of SBR1502 was changed into 20 weight section from 15 weight section.

[0046] The blending ratio of coal (constituent combination) and evaluation result of each example and the example of a comparison are combined, and are shown in the following Table 1 and 2.

[0047] From the evaluation result shown in Table 1, that the diameter of a mean cell has the detailed diameter 150 micrometers or less of a cell made it clear, the sponge roller using the rubber constituent of an example 1 to the example 5 having a low sponge degree of hardness. In case the curing speeds of EPDM and SBR which are base rubber differ, and such a constituent is heated and it foams since the curing speed of SBR is early although the ground it is alike by carrying out little addition of this SBR, and the diameter of a cell is therefore improved is not certain, SBR cures previously and estimates that an internal pressure is for such. Furthermore, in the sponge roller using the rubber constituent of the example 1 of a comparison, since the diameter of a cell was coarse, it became clear that it is unsuitable as sponge rollers, such as an imprint roller. Moreover, in the sponge roller using the rubber constituent of the example 2 of a comparison, it elapsed, and in order [that there are many additions of SBR] not to carry out a curing foaming, it turns out that practical use use cannot be presented.

[0048]

[Table 1]

	実施例				
	1	2	3	4	5
配合(重量部)					
EPDM	85	90	93	95	97
SBR	15	10	7	5	3
評価結果					
未加硫ゴムの特性					
ムニ-粘度 (ML ₁₊₄ 100°C)	29	28	28	27	27
スボンジの物性					
スボンジ硬度 (アカ-C)	40	37	36	35	33
平均セル径 (μm)	90	90	90	100	140

[0049]

[Table 2]

	比較例	
	1	2
配合(重量部)		
EPDM	100	80
SBR	0	20
評価結果		
未加硫ゴムの特性		
ムニ-粘度 (ML ₁₊₄ 100°C)	26	発泡
スボンジの物性		
スボンジ硬度 (アカ-C)	30	せず
平均セル径 (μm)	200	ず

[0050] O EPDM:id ***** E5754 Sumitomo Chemical Co., Ltd. make Tradename OSBR:SBR1502 (tradename by Sumitomo Chemical Co., Ltd.) of EPDM (Mooney viscosity 30 (1+4100 degrees C of MLs))

O As common combination besides combination given in a table The following Used - stearin acid:***** S-20 ([by Kao Corp.]) The tradename 70 weight section and calcium-carbonate:NS#100 ([by Japanese east powdering industrial incorporated company]) Two sorts (tradename by Sakai Chemical Industry Co., Ltd.) of 1 weight section and zinc-oxide:zinc oxides 5 weight section and FEF carbon:***** SO (tradename by Tokai Carbon Co., Ltd.) tradename 40 weight section and the softener:Diana process oil PW380 ([by Idemitsu Kosan, Inc.]) The tradename 50 weight section and calcium-oxide:Vesta 18 (tradename by Inoue lime industrial incorporated company) Kawaguchi Chemical Industry Co., Ltd. make of 5 weight section and an accelerator CZ:N-cyclohexyl benzothiazole The tradename by Kawaguchi Chemical Industry Co., Ltd. of the tradename 1.0 weight section and accelerator DM:dibenzo thiazole disulfide Kawaguchi Chemical Industry Co., Ltd. make of 0.5 weight section and an accelerator M:2-mercaptopbenzothiazole Tradename Kawaguchi Chemical Industry Co., Ltd. make of 0.5 weight section and accelerator TRA:dibenzo methylene sulfide Tradename Kawaguchi Chemical Industry Co., Ltd. make of 0.6 weight section and accelerator TMT:tetramethyl thiuram disulfide Tradename 0.5 weight section and sulfur: -- the *** mark flour sulfur 325mesh(tradename by Tsurumi chemical-industry incorporated company) 1.0 weight section, and foaming agent A.D.C.A : (***** carvone amide) Cell microphone C-1

(tradename by 3 ***** industrial incorporated company) 7.0 weight section [0051]

[Effect of the invention] As explained above, the manufacture technique of the sponge rubber and the sponge roller using the rubber constituent and this rubber constituent with which the diameter of a mean cell can offer the sponge rubber of the detailed and uniform diameter 150 micrometers or less of a cell also in the free foaming method was able to be offered by this invention.

[Translation done.]

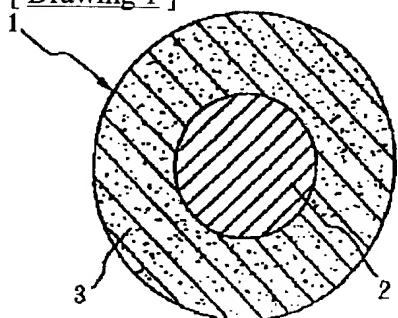
* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Translation done.]